



September 2, 2014
ES-3304.01

Earth Solutions NW LLC

- Geotechnical Engineering
- Construction Monitoring
- Environmental Sciences

Sundquist Homes, LLC
16108 Ash Way, Suite 201
Lynnwood, Washington 98087

Attention: Ms. Christy Dopp

Subject: Response to Comments (Lot 1)
Layton Crossing
1020 Northeast 145th Street
Shoreline, Washington

Building Permit Application – 121910

Reference: City of Shoreline
Review Comments Memo
Building Permit Applications – 121910
August 21, 2014

LDC, Inc.
Site Plans
Dated June 2, 2014

Earth Solutions NW, LLC
Geotechnical Engineering Study
ES-3304, May 9, 2014



Dear Ms. Dopp:

As requested, Earth Solutions NW, LLC (ESNW) has prepared this letter addressing the referenced City of Shoreline Planning and Community Development comments memos. The comments pertinent to the geotechnical aspects of the project are provided below, followed by our responses.

Civil Comment 5 – 121910 – Revised Plans call out a structural retaining wall on the plans (Lock and Load). Details and drawings stamped by an engineer are required.

ESNW Response – The stamped Lock and Load retaining wall design sheet (LK1) and calculations are provided as an attachment.

Civil Comment 6 – 121910 – Revised Plans show a rockery over 4' in height. Details and drawings stamped by an engineer are required.

ESNW Response – The stamped rockery detail is provided as an attachment.

Zoning Comment 4 – 121910 – The site plans for this parcel do not adequately identify the top/toe of the steep slope critical areas or the recommended buffers as identified in the geotech report from Raymond Coglas, Earth Solutions NW, LLC. Please submit a copy of the Layton Crossing Slope Analysis Map, dated April 8, 2014, used by Earth Solutions in preparing the Geotechnical Engineering Study for Layton Crossing, updated May 9, 2014. Additionally, please revise all site plan (Sheets SP-01, TR-01, RD-01, and UT-01) to show the identified top/toe of the steep slope areas to the west and south. All site plans must show all three buffer recommendations – 25-foot structure setback, 20-foot infiltration trench setback, and minimum 15-foot grading setback.

ESNW Response – As stated in the referenced geotechnical engineering study, we recommend a 25-foot structure setback, and 20-foot infiltration trench setback from non-exempt steep slope areas. Additionally, we recommend a 15-foot grading setback from non-exempt steep slope areas.

Zoning Comment 5 – 121910 – SMC 20.80.230 allows for the standard 50-foot setback to be reduced based on the recommendations of a qualified professional, however in no case can the buffer be reduced to less than 15-feet unless the slope is exempted under SMC 20.80.030. No portion of the identified steep slopes was recommended for exemption under 20.80.030 in the Earth Solutions NW, LLC report. Please revise the proposed site grading and clearing limits so that no tree removal or grading occurs within 15 feet of the top/toe of the identified steep slopes.

ESNW Response – As stated in the referenced geotechnical engineering study, in our opinion, the steep slope descending to Northeast 145th Street to the south was created through prior legal grading activity associated with the construction of Northeast 145th Street. Soils are comprised of very dense and stable till deposits, and the proposed grading adjacent to the steep slope will not adversely impact the slope and site. We recommend the steep slope descending to Northeast 145th Street to the south shall be exempt from the provisions of Chapter 20.80 of the Shoreline Municipal Code (SMC), per SMC 20.80.030.F. In this respect, the proposed grading along the top of the existing slope (zero buffer), is acceptable from a geotechnical standpoint.

We trust this letter and response to City of Shoreline review comments meet your current needs. Should you have questions, or if additional information is required, please call.

Sincerely,

EARTH SOLUTIONS NW, LLC

Raymond A. Coglas, P.E.
Principal



Attachment: Rockery Detail
Lock and Load Retaining Wall Design Sheet (LK1)
Lock and Load Retaining Wall Calculations

cc: LDC, Inc.
Attention: Mr. Matthew Merritt (Email only)

GENERAL NOTES:

Rockery construction is a craft and depends largely on the skill and experience of the builder. A rockery is a protective system which helps retard the weathering and erosion process on an exposed soil face. While by its nature (mass, size and shape of rocks) it will provide some degree of retention, it is not a designed or engineered system in the sense a reinforced concrete retaining wall would be considered designed or engineered. The degree of retention achieved is dependent on the size of the rock used; that is, the mass or weight, and the height of the wall being constructed. The larger the rock, the more competent the rockery should be.

Rockeries should be considered maintenance items that will require periodic inspection and repair. They should be located so that they can be reached by a contractor if repairs become necessary.

- ...Maximum inclination of the slopes above and behind rockeries should be 2:1 (Horizontal : Vertical).
- ...Minimum thickness of rock filter layer behind rockery is 18 inches.
- ...Minimum of 12 inch embedment into undisturbed native soil or compacted fill placed in accordance with report recommendations.
- ...Maximum rockery height H = 8 feet.
- ...Rockeries greater than 8 feet in height to be installed under periodic or full time observation of the geotechnical engineer.

Unless otherwise specified in writing by the rockery "designers", all rocks placed in the lower two-thirds of the wall should be 5 to 6 man rock, 4,000 lbs. or larger. Rocks placed above this level should gradually decrease in size with increasing wall height using 3 to 5 man rock, 700 to 6,000 lbs.

The long dimension of the rocks should extend back towards the cut or fill face to provide maximum stability. Rocks should be placed to avoid continuous joint planes in vertical or lateral directions. Each rock should bear on two or more rocks below it, with good flat-to-flat contact.

All rockeries over 4 feet in height should be constructed on basis of wall mass, not square footage of face.

Size	Approximate Weight - lbs.	Approximate Diameter
1 man	50-200	12-18"
2 man	200-700	18-28"
3 man	700-2,000	28-36"
4 man	2,000-4,000	36-48"
5 man	4,000-6,000	48-54"
6 man	6,000-8,000	54-60"

Reference: Local quarry weight study using average weights of no less than six rocks of each man size conducted in January 1988.

LEGEND:



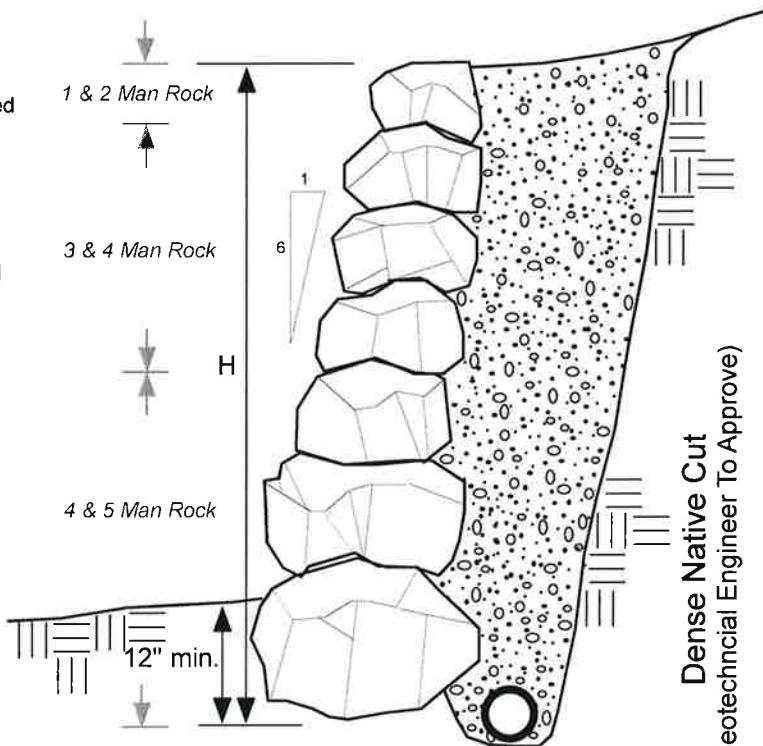
Drainage materials to consist of clean angular well-graded quarry spalls, with 4-inch maximum size, or other material approved by the geotechnical engineer.



Undisturbed firm Native Soil.



Drain pipe; 4-inch minimum diameter, perforated or slotted rigid plastic PVC pipe, laid with a positive gradient to discharge under control, well away from the rockery.



NOT TO SCALE - SCHEMATIC ONLY
NOT A CONSTRUCTION DRAWING

NOTES:

Rockery construction to be completed in accordance with ARC Guidelines.

Earth Solutions NW representative to observe rockery construction and prepare final report.


Earth Solutions NW LLC
Geotechnical Engineering, Construction Monitoring and Environmental Sciences

NATIVE CUT ROCKERY DETAIL
Layton Crossing
Shoreline, Washington

Drwn. GLS	Date 08/28/2014	Proj. No. 3304.01
Checked HTW	Date Aug. 2014	Plate 1

DESIGN NOTES:

Reference: LDC, Inc., Site Plans, June 2, 2014
 Earth Solutions NW, LLC, Geotechnical Engineering Study, May 9, 2014
 The following design assumptions were used:
 Internal angle of friction for reinforced soil = 32 degrees (design only - see Material Note "F")
 Unit weight of reinforced soil = 125 psf
 Maximum wall height = 12.00 feet
 Batter of wall = 1H : 10V
 Surcharge = 250 psf Traffic Surcharge

TECHNICAL SPECIFICATIONS FOR MECHANICALLY STABILIZED LOCK & LOAD RETAINING WALLS

GENERAL:

- A. The work involves the supply and installation of soil reinforced retaining walls. The Concrete Panels and Counterforts will consist of Lock & Load Stone. Counterfort and Geogrid are the types of soil reinforcement. The work will include, but is not limited to:
 - A-1 excavation to the grades shown on the civil drawings
 - A-2 supply and installation of geogrid reinforcement
 - A-3 supply and installation of drainage fill and piping
 - A-4 supply and installation of segmental Lock & Load Stones
 - A-5 supply and installation of retained and reinforced soil fill
- B. The walls shall be installed on undisturbed Native Soils or Structural Fill, as appropriate.

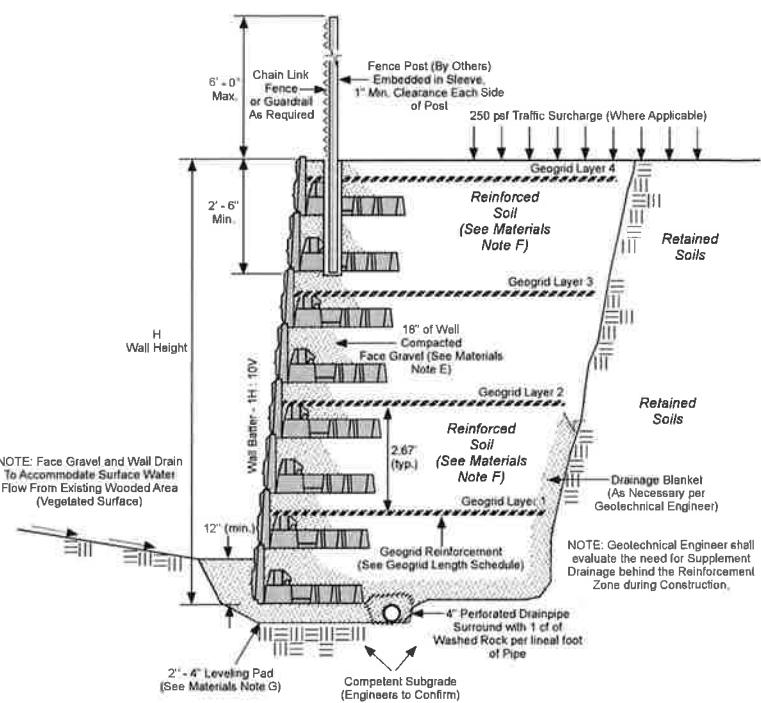
MATERIALS

- A. Concrete Panels and Counterforts are locked together to form a "Stone". The retaining walls have been designed on the basis of Lock & Load Retaining Wall "Stones". Stones are to be purchased from a licensed Lock & Load manufacturer. The Lock & Load trademark on each pallet identifies Lock & Load products.
- B. Information on the purchase of Lock & Load products can be obtained through:

Lock & Load Retaining Walls Ltd.
 Tel. (877) 901-9990
 Website: www.lock-load.com
- C. Geogrid - See Geogrid Schedule.
- D. Drainage Fill - Drainage Fill placed around and above the perforated drainage pipe shell consist of concrete aggregate between 3/4 inch and 1 1/2 inch.
- E. Face Gravel - 3/4 inch to 1 inch Clean Crushed Rock, no fines. Face Gravel shall be compacted thoroughly to ensure no settlement of panels.
- F. Reinforced Backfill - Suitable "free-draining" granular material approved by the Geotechnical Engineer.
- G. Leveling Pad - The Leveling Pad shall consist of angular, crushed aggregate of maximum size of 3/4 inch. The Leveling Pad Fill may be single size or may be well graded containing a maximum of 5% passing the #200 sieve.

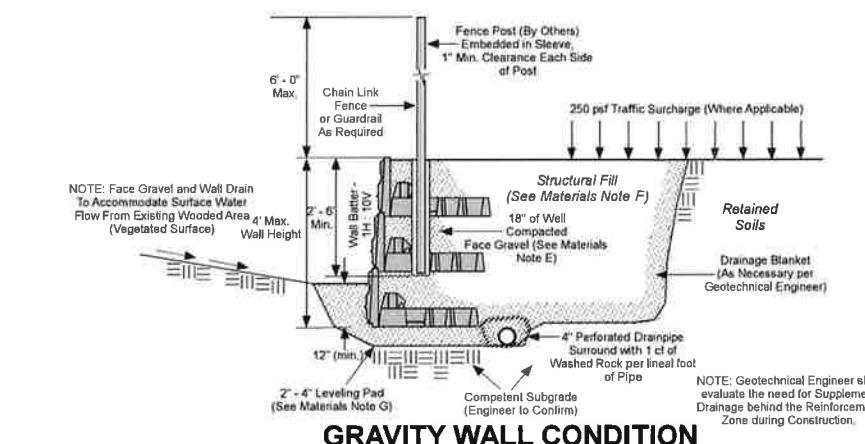
EXECUTION

- A. Contractor shall excavate to the lines and grades shown on the construction drawings. The Geotechnical Engineer should observe the excavation prior to the placement of the leveling material or fill soils.
- B. Over-excavation of deleterious soils or rock shall be replaced with material meeting the specifications described in the section "Material F" above, and compacted to 95% of ASTM D-1557-91 (Modified Proctor) within 2% of the optimum moisture content of the soil.
- C. The first course of concrete Lock & Load Stones shall be placed on the Leveling Pad and the alignment and level checked.
- D. Stones shall be placed with the top of the panel level and parallel to the wall face. The Counterfort Base installs horizontal and perpendicular to the face of the retaining wall.
- E. Geogrid shall be oriented with the highest strength axis perpendicular to the wall alignment.
- F. Geogrid reinforcement shall be placed at the levels and to the lengths shown on the drawings beginning at the back of the Lock & Load Panels.
- G. The geogrid shall be laid horizontally in the direction perpendicular to the face of the retaining wall. The geogrid shall be pulled taut, free of wrinkles and anchored prior to backfill placement on the geogrid.
- H. The geogrid reinforcement shall be continuous throughout their embedment lengths. Spliced connection between shorter pieces of geogrid is not permitted.
- I. The drainage pipe discharge points shall be connected to approved discharge.
- J. Reinforced and Retained Backfill shall be placed, spread and compacted in such a manner that minimizes the development of slack in the geogrid.
- K. Reinforced and Retained Backfill shall be placed and compacted in lifts not to exceed 8 inches where hand compaction equipment is used and not more than 12 inches where heavy compaction equipment is used. FIRST - compact over tail of Counterfort then away from the retaining wall structure. Hand operated compaction equipment (700 lbs. to 1,000 lbs.) Vibratory Plate shall be used to compact face gravel at wall face.
- L. Reinforced and Retained Backfill shall be compacted to 95% of the maximum density as determined by ASTM D-1557-91 (Modified Proctor) or equivalent. The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer and shall be within 2 percentage points of the optimum moisture content.
- M. Hand-operated equipment (700 lbs. to 1,000 lbs. Vibratory Plate) shall be used within 26 inches of the front face of the concrete facing.
- N. Tracked construction equipment shall not be operated directly upon the geogrid reinforcement. A minimum fill thickness of 6 inches is required prior to operation of tracked vehicles over the geogrid.
- O. Rubber tired equipment may pass over the geogrid reinforcement at slow speeds less than 5 mph. Sudden braking and sharp turning shall be avoided.
- P. At the end of each day of operation, the contractor shall slope the last lift of reinforced backfill away from the wall units to direct runoff away from the wall face. The contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.



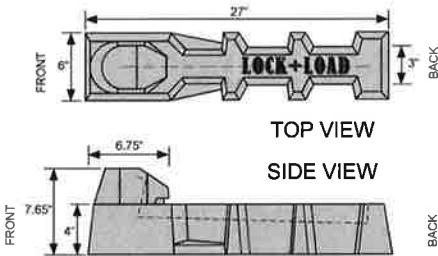
TYPICAL WALL SECTION

NOT - TO - SCALE



GRAVITY WALL CONDITION
(4 Foot Max. Height)

NOT - TO - SCALE



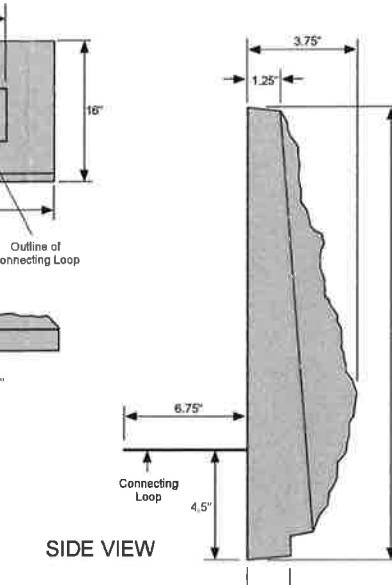
TOP VIEW
SIDE VIEW



NOTES:

1. Installation to be completed in accordance with manufacturer's specifications.
2. Do not scale from drawings.

LOCK & LOAD COUNTERFORT



NOT - TO - SCALE

LOCK & LOAD PANEL



Lock - Load Wall Design
LAYTON CROSSING
 Shoreline, Washington

Date	
Revisions	

Proj. No.	3304.01
Date	08/05/2014
Drawn By	GJS
Checked By	HWW

Sheet No.	
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LK1

AASHTO 2002 ASD DESIGN METHOD

Layton Crossing

MSEW(3.0): Update # 14.1

PROJECT IDENTIFICATION

Title: Layton Crossing
Project Number: ES-3304.01
Client: Keywest Retaining Systems, Inc.
Designer: HTW
Station Number: 130

Description:

12 Foot Lock and Load wall with Traffic Surcharge

Company's information:

Name: Earth Solutions NW, LLC
Street: 1805 136th Pl NE, Ste 201

Bellevue, WA 98005
Telephone #: (425) 284-3300
Fax #: _____
E-Mail: _____

Original file path and name: C:\Users\henry.wright\Documents\Earth Solutions\3304.01....
.....4.01 LnL\12.Foot.BEN

Original date and time of creating this file: August 29, 2014

PROGRAM MODE:

ANALYSIS
of a SIMPLE STRUCTURE
using GEOGRID as reinforcing material.



MSEW – Mechanically Stabilized Earth Walls

Layton Crossing

Present Date/Time: Fri Aug 29 10:13:19 2014

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SOIL DATA

REINFORCED SOIL

Unit weight, γ 125.0 lb/ft³
 Design value of internal angle of friction, ϕ 32.0 °

RETAINED SOIL

Unit weight, γ 125.0 lb/ft³
 Design value of internal angle of friction, ϕ 32.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)
1 cu. yd. weight = 125.6 lb./sq.

Equivalent unit weight, γ_{equiv}	125.0 lb/ft ³
Equivalent internal angle of friction, ϕ_{equiv}	32.0 °
Equivalent cohesion, c_{equiv}	0.0 lb/ft ²

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.3073 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)
 Inclination of internal slip plane, $\psi = 61.00^\circ$ (see Fig. 28 in DEMO 82).
 Ka (external stability) = 0.3073 (if batter is less than 10°, Ka is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): $N_c = 35.49$ $N_\gamma = 30.21$

SEISMICITY

Maximum ground acceleration coefficient, A = 0.200

Design acceleration coefficient in Internal Stability: $K_h = A_m = 0.250$

Design acceleration coefficient in External Stability: $K_h_d = 0.099 \Rightarrow K_h = A_m = 0.134$

(Kh in External Stability is based on allowable displacement, d = 25 mm. using AASHTO 2002 equation)

$$Kae(Kh > 0) = 0.3540 \quad Kae(Kh = 0) = 0.2705 \quad \Delta Kae = 0.0835$$

Seismic soil-geogrid friction coefficient, F^* is 80.0% of its specified static value.

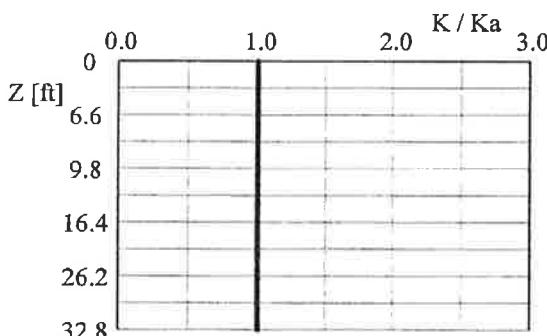
**INPUT DATA: Geogrids
(Analysis)**

D A T A	Geogrid type #1	Geogrid type #2	Geogrid type #3	Geogrid type #4	Geogrid type #5
Tult [lb/ft]	4700.0	7400.0			
Durability reduction factor, RFd	1.10	1.10			
Installation-damage reduction factor, RFid	1.10	1.10			
Creep reduction factor, RFC	1.58	1.58	N/A	N/A	N/A
Fs-overall for strength	N/A	N/A			
Coverage ratio, Rc	1.000	1.000			
Friction angle along geogrid-soil interface, ρ	21.33	21.33			
Pullout resistance factor, F*	0.80 · tan ϕ	0.80 · tan ϕ	N/A	N/A	N/A
Scale-effect correction factor, α	0.8	0.8			

Note: Z for calculating K/Ka and F* is measured from roadway surface (FHWA-NHI-10-024).

Variation of Lateral Earth Pressure Coefficient With Depth

Z	K / Ka
0 ft	1.00
3.3 ft	1.00
6.6 ft	1.00
9.8 ft	1.00
13.1 ft	1.00
16.4 ft	1.00
19.7 ft	1.00



MSEW -- Mechanically Stabilized Earth Walls

Present Date/Time: Fri Aug 29 10:13:19 2014

Layton Crossing

\Users\henry wright\Documents\Earth Solutions\3304.01.LnL\12 Foot BEN

INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, H_d 12.00 [ft] { Embedded depth is $E = 1.33$ ft, and height above top of finished bottom grade is $H = 10.67$ ft }

Batter, ω 5.7 [deg]

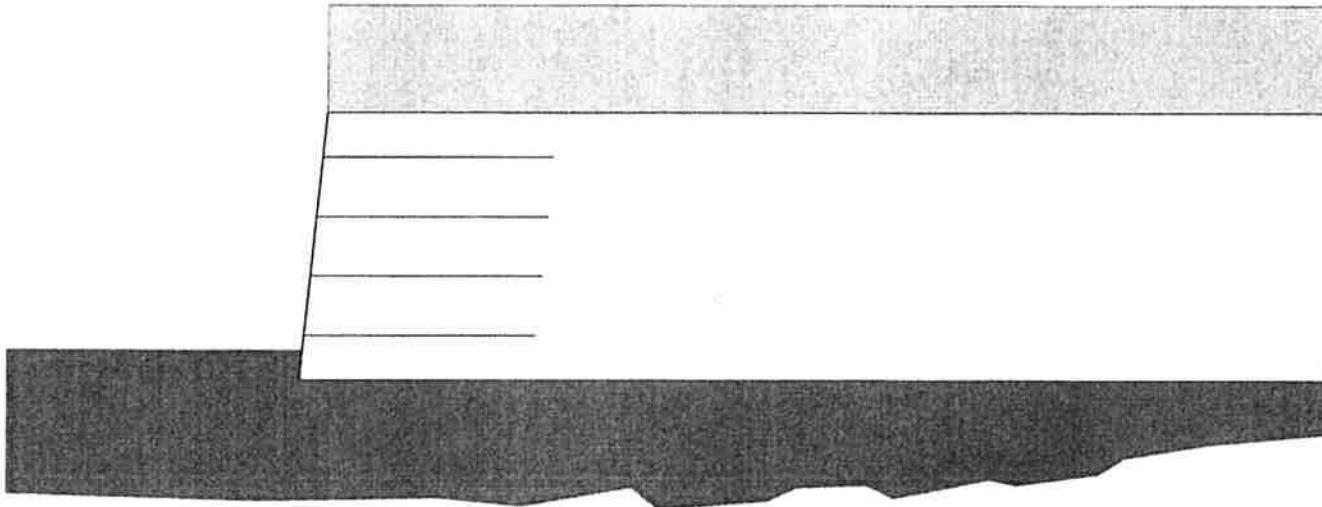
Backslope, β 0.0 [deg]

Backslope rise 0.0 [ft] Broken back equivalent angle, $I = 0.00^\circ$ (see Fig. 25 in DEMO 82)

UNIFORM SURCHARGE

Uniformly distributed dead load is 0.0 [lb/ft²], and live load is 250.0 [lb/ft²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 8 10 [ft]



ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, $F_s = 8.63$, Meyerhof stress = 1888 lb/ft².Foundation Interface: Direct sliding, $F_s = 2.390$, Eccentricity, $e/L = 0.0884$, F_s -overturning = 4.50

#	GEO GRID			CONNECTION			Geogrid strength F_s	Pullout resistance F_s	Direct sliding F_s	Eccentricity e/L	Product name
	Elevation [ft]	Length [ft]	Type #	F_s -overall [pullout resistance]	F_s -overall [connection break]	F_s -overall [geogrid strength]					
1	2.00	10.00	2	N/A	2.43	2.45	2.450	5.751	1.725	0.0617	Miragrid 8XT
2	4.67	10.00	1	N/A	2.55	2.57	2.574	6.042	2.161	0.0339	Miragrid 5XT
3	7.33	10.00	1	N/A	3.57	3.60	3.602	4.562	2.863	0.0146	Miragrid 5XT
4	10.00	10.00	1	N/A	5.18	5.23	5.233	2.321	4.194	0.0033	Miragrid 5XT

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

Bearing capacity, $F_s = 6.57$, Meyerhof stress = 2165 lb/ft².Foundation Interface: Direct sliding, $F_s = 1.711$, Eccentricity, $e/L = 0.1521$, F_s -overturning = 2.92

#	GEO GRID			CONNECTION			Geogrid strength F_s	Pullout resistance F_s	Direct sliding F_s	Eccentricity e/L	Product name
	Elevation [ft]	Length [ft]	Type #	F_s -overall [pullout resistance]	F_s -overall [connection break]	F_s -overall [geogrid strength]					
1	2.00	10.00	2	N/A	2.15	2.17	2.172	3.827	1.252	0.1055	Miragrid 8XT
2	4.67	10.00	1	N/A	2.15	2.17	2.175	3.747	1.610	0.0571	Miragrid 5XT
3	7.33	10.00	1	N/A	2.93	2.96	2.959	2.716	2.229	0.0239	Miragrid 5XT
4	10.00	10.00	1	N/A	4.12	4.16	4.159	1.319	3.566	0.0050	Miragrid 5XT

AASHTO 2002 ASD DESIGN METHOD

Layton Crossing

MSEW(3.0): Update # 14.1

PROJECT IDENTIFICATION

Title: Layton Crossing
Project Number: ES-3304.01
Client: Keywest Retaining Systems, Inc.
Designer: HTW
Station Number: 130

Description:

10.67 Foot Lock and Load wall with Traffic Surcharge

Company's information:

Name: Earth Solutions NW, LLC
Street: 1805 136th Pl NE, Ste 201

Bellevue, WA 98005
Telephone #: (425) 284-3300
Fax #:
E-Mail:

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MSEW -- Mechanically Stabilized Earth Walls

Layton Crossing

Present Date/Time: Fri Aug 29 10:13:27 2014

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SOIL DATA

REINFORCED SOIL

Unit weight, γ	125.0 lb/ft ³
Design value of internal angle of friction, ϕ	32.0 °

RETAINED SOIL

Unit weight, γ	125.0 lb/ft ³
Design value of internal angle of friction, ϕ	32.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight, γ_{equiv}	125.0 lb/ft ³
Equivalent internal angle of friction, ϕ_{equiv}	32.0 °
Equivalent cohesion, c_{equiv}	0.0 lb/ft ²

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

K_a (internal stability) = 0.3073 (if batter is less than 10°, K_a is calculated from eq. 15. Otherwise, eq. 38 is utilized)
Inclination of internal slip plane, $\psi = 61.00^\circ$ (see Fig. 28 in DEMO 82).

K_a (external stability) = 0.3073 (if batter is less than 10°, K_a is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): $N_c = 35.49$ $N_q = 30.21$

SEISMICITY

Maximum ground acceleration coefficient, $A = 0.200$

Design acceleration coefficient in Internal Stability: $K_h = A_m = 0.250$

Design acceleration coefficient in External Stability: $K_h_d = 0.099 \Rightarrow K_h = A_m = 0.134$

(K_h in External Stability is based on allowable displacement, $d = 25$ mm. using AASHTO 2002 equation)

$K_{ae} (K_h > 0) = 0.3540$ $K_{ae} (K_h = 0) = 0.2705$ $\Delta K_{ae} = 0.0835$

Seismic soil-geogrid friction coefficient, F^* is 80.0% of its specified static value.

MSEW -- Mechanically Stabilized Earth Walls

Layton Crossing
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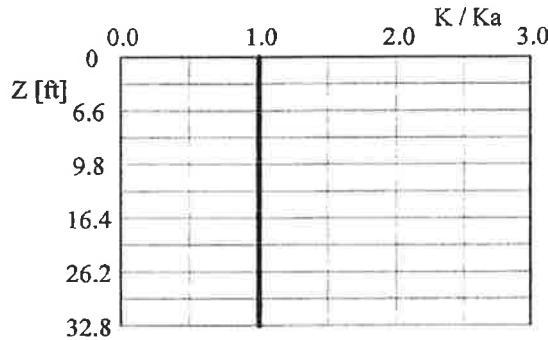
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Durability reduction factor, RFd	1.10	1.10			
Installation-damage reduction factor, RFid	1.10	1.10			
Creep reduction factor, RFC	1.58	1.58	N/A	N/A	N/A
Fs-overall for strength	N/A	N/A			
Coverage ratio, Rc	1.000	1.000			
Friction angle along geogrid-soil interface, ρ	21.33	21.33			
Pullout resistance factor, F*	0.80 · tan ϕ	0.80 · tan ϕ	N/A	N/A	N/A
Scale-effect correction factor, α	0.8	0.8			

Note: Z for calculating K/Ka and F* is measured from roadway surface (FHWA-NHI-10-024).

Variation of Lateral Earth Pressure Coefficient With Depth

Z	K / Ka
0 ft	1.00
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6.6 ft	1.00
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13.1 ft	1.00
16.4 ft	1.00
19.7 ft	1.00



MSEW -- Mechanically Stabilized Earth Walls

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Layton Crossing

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INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, H_d 10.66 [ft] { Embedded depth is $E = 1.33$ ft, and height above top of finished bottom grade is $H = 9.33$ ft }

Batter, ω 5.7 [deg]

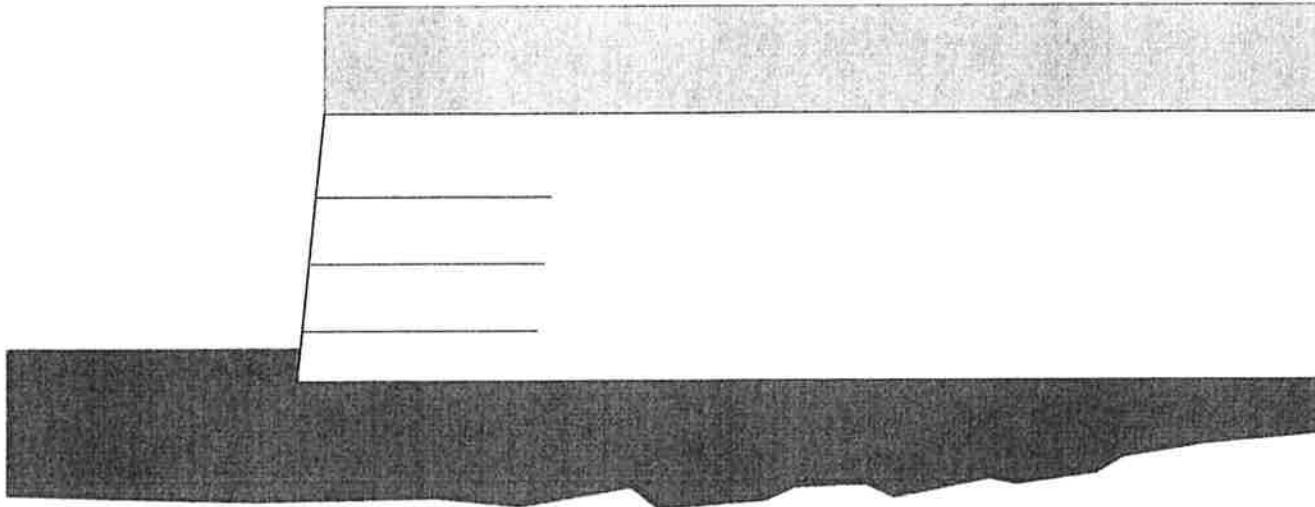
Backslope, β 0.0 [deg]

Backslope rise 0.0 [ft] Broken back equivalent angle, $I = 0.00^\circ$ (see Fig. 25 in DEMO 82)

UNIFORM SURCHARGE

Uniformly distributed dead load is 0.0 [lb/ft²], and live load is 250.0 [lb/ft²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 8 10 [ft]

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, $F_s = 8.60$, Meyerhof stress = 1706 lb/ft².Foundation Interface: Direct sliding, $F_s = 2.349$, Eccentricity, $e/L = 0.0904$, F_s -overturning = 4.43

G E O G R I D			C O N N E C T I O N				Geogrid strength F_s	Pullout resistance F_s	Direct sliding F_s	Eccentricity e/L	Product name
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [geogrid strength]					
1	2.00	9.00	1	N/A	1.73	1.75	1.746	4.974	1.720	0.0607	Miragrid 5XT
2	4.67	9.00	1	N/A	2.98	3.01	3.005	5.033	2.214	0.0305	Miragrid 5XT
3	7.33	9.00	1	N/A	3.14	3.17	3.172	2.434	3.063	0.0108	Miragrid 5XT

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

Bearing capacity, $F_s = 6.63$, Meyerhof stress = 1944 lb/ft².Foundation Interface: Direct sliding, $F_s = 1.697$, Eccentricity, $e/L = 0.1524$, F_s -overturning = 2.92

G E O G R I D			C O N N E C T I O N				Geogrid strength F_s	Pullout resistance F_s	Direct sliding F_s	Eccentricity e/L	Product name
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [geogrid strength]					
1	2.00	9.00	1	N/A	1.51	1.53	1.529	3.249	1.263	0.1012	Miragrid 5XT
2	4.67	9.00	1	N/A	2.46	2.49	2.488	3.030	1.681	0.0496	Miragrid 5XT
3	7.33	9.00	1	N/A	2.66	2.69	2.686	1.514	2.470	0.0166	Miragrid 5XT

AASHTO 2002 ASD DESIGN METHOD

Layton Crossing

MSEW(3.0): Update # 14.1

PROJECT IDENTIFICATION

Title: Layton Crossing
Project Number: ES-3304.01
Client: Keywest Retaining Systems, Inc.
Designer: HTW
Station Number: 130

Description:

9.33 Foot Lock and Load wall with Traffic Surcharge

Company's information:

Name: Earth Solutions NW, LLC
Street: 1805 136th Pl NE, Ste 201

Bellevue, WA 98005
Telephone #: (425) 284-3300
Fax #:
E-Mail:

Original file path and name: C:\Users\henry.wright\Documents\Earth Solutions\3304.01.....
.....01 LnL\9.33 Foot.BEN

Original date and time of creating this file: August 29, 2014

PROGRAM MODE:

ANALYSIS
of a SIMPLE STRUCTURE
using GEOGRID as reinforcing material.



SOIL DATA**REINFORCED SOIL**

Unit weight, γ	125.0 lb/ft ³
Design value of internal angle of friction, ϕ	32.0 °

RETAINED SOIL

Unit weight, γ	125.0 lb/ft ³
Design value of internal angle of friction, ϕ	32.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight, γ_{equiv}	125.0 lb/ft ³
Equivalent internal angle of friction, ϕ_{equiv}	32.0 °
Equivalent cohesion, c_{equiv}	0.0 lb/ft ²

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

K_a (internal stability) = 0.3073 (if batter is less than 10°, K_a is calculated from eq. 15. Otherwise, eq. 38 is utilized)
 Inclination of internal slip plane, $\psi = 61.00^\circ$ (see Fig. 28 in DEMO 82).

K_a (external stability) = 0.3073 (if batter is less than 10°, K_a is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): $N_c = 35.49$ $N_g = 30.21$

SEISMICITY

Maximum ground acceleration coefficient, $A = 0.200$

Design acceleration coefficient in Internal Stability: $K_h = A_m = 0.250$

Design acceleration coefficient in External Stability: $K_h - d = 0.099 \Rightarrow K_h = A_m = 0.134$

(K_h in External Stability is based on allowable displacement, $d = 25$ mm. using AASHTO 2002 equation)

$K_{ae} (K_h > 0) = 0.3540$ $K_{ae} (K_h = 0) = 0.2705$ $\Delta K_{ae} = 0.0835$

Seismic soil-geogrid friction coefficient, F^* is 80.0% of its specified static value.

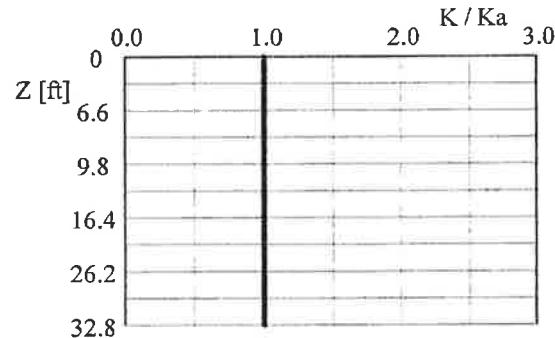
**INPUT DATA: Geogrids
(Analysis)**

DATA	Geogrid type #1	Geogrid type #2	Geogrid type #3	Geogrid type #4	Geogrid type #5
Tult [lb/ft]	4700.0	7400.0			
Durability reduction factor, RFd	1.10	1.10			
Installation-damage reduction factor, RFid	1.10	1.10			
Creep reduction factor, RFC	1.58	1.58	N/A	N/A	N/A
Fs-overall for strength	N/A	N/A			
Coverage ratio, Rc	1.000	1.000			
Friction angle along geogrid-soil interface, ϕ	21.33	21.33			
Pullout resistance factor, F*	0.80 · tan ϕ	0.80 · tan ϕ	N/A	N/A	N/A
Scale-effect correction factor, α	0.8	0.8			

Note: Z for calculating K/Ka and F* is measured from roadway surface (FHWA-NHI-10-024).

Variation of Lateral Earth Pressure Coefficient With Depth

Z	K / Ka
0 ft	1.00
3.3 ft	1.00
6.6 ft	1.00
9.8 ft	1.00
13.1 ft	1.00
16.4 ft	1.00
19.7 ft	1.00



MSEW -- Mechanically Stabilized Earth Walls

Layton Crossing

Present Date/Time: Fri Aug 29 10:14:33 2014

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INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, H_d 9.33 [ft] { Embedded depth is $E = 1.33$ ft, and height above top of finished bottom grade is $H = 8.00$ ft }

Batter, ω 5.7 [deg]

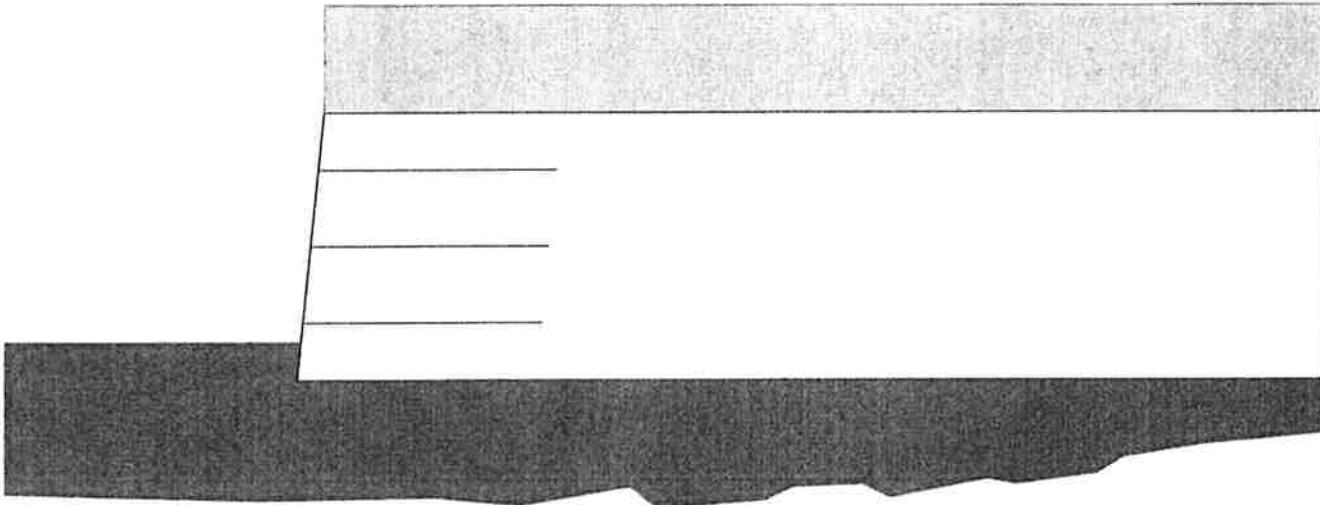
Backslope, β 0.0 [deg]

Backslope rise 0.0 [ft] Broken back equivalent angle, $I = 0.00^\circ$ (see Fig. 25 in DEMO 82)

UNIFORM SURCHARGE

Uniformly distributed dead load is 0.0 [lb/ft²], and live load is 250.0 [lb/ft²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 [ft]



ANALYSIS: CALCULATED FACTORS (Static conditions)Bearing capacity, $F_s = 8.56$, Meyerhof stress = 1526 lb/ft².Foundation Interface: Direct sliding, $F_s = 2.299$, Eccentricity, $e/L = 0.0930$, F_s -overturning = 4.35

G E O G R I D			C O N N E C T I O N				Geogrid strength F_s	Pullout resistance F_s	Direct sliding F_s	Eccentricity e/L	Product name
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [geogrid strength]					
1	2.00	8.00	I	N/A	1.97	1.99	1.986	4.199	1.713	0.0594	Miragrid 5XT
2	4.67	8.00	I	N/A	3.57	3.61	3.605	4.014	2.280	0.0265	Miragrid 5XT
3	7.33	8.00	I	N/A	5.19	5.24	5.245	1.991	3.347	0.0068	Miragrid 5XT

ANALYSIS: CALCULATED FACTORS (Seismic conditions)Bearing capacity, $F_s = 6.69$, Meyerhof stress = 1725 lb/ft².Foundation Interface: Direct sliding, $F_s = 1.678$, Eccentricity, $e/L = 0.1531$, F_s -overturning = 2.91

G E O G R I D			C O N N E C T I O N				Geogrid strength F_s	Pullout resistance F_s	Direct sliding F_s	Eccentricity e/L	Product name
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [geogrid strength]					
1	2.00	8.00	I	N/A	1.74	1.76	1.762	2.797	1.276	0.0960	Miragrid 5XT
2	4.67	8.00	I	N/A	3.00	3.03	3.026	2.466	1.775	0.0411	Miragrid 5XT
3	7.33	8.00	I	N/A	4.25	4.30	4.296	1.181	2.845	0.0094	Miragrid 5XT

AASHTO 2002 ASD DESIGN METHOD Layton Crossing

MSEW(3.0): Update # 14.1

PROJECT IDENTIFICATION

Title: Layton Crossing
Project Number: ES-3304.01
Client: Keywest Retaining Systems, Inc.
Designer: HTW
Station Number: 130

Description:

8 Foot Lock and Load wall with Traffic Surcharge

Company's information:

Name: Earth Solutions NW, LLC
Street: 1805 136th Pl NE, Ste 201

Bellevue, WA 98005
Telephone #: (425) 284-3300
Fax #:
E-Mail:

Original file path and name: C:\Users\henry.wright\Documents\Earth Solutions\3304.01.....
.....04.01 LnL8 Foot.BEN

Original date and time of creating this file: August 29, 2014

PROGRAM MODE:

ANALYSIS
of a SIMPLE STRUCTURE
using GEOGRID as reinforcing material.



MSEW -- Mechanically Stabilized Earth Walls

Present Date/Time: Fri Aug 29 10:15:09 2014

Layout Crossing

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SOIL DATA

REINFORCED SOIL

Unit weight, γ	125.0 lb/ft ³
Design value of internal angle of friction, ϕ	32.0 °

RETAINED SOIL

Unit weight, γ	125.0 lb/ft ³
Design value of internal angle of friction, ϕ	32.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight, γ_{equiv}	125.0 lb/ft ³
Equivalent internal angle of friction, ϕ_{equiv}	32.0 °
Equivalent cohesion, c_{equiv}	0.0 lb/ft ²

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

K_a (internal stability) = 0.3073 (if batter is less than 10°, K_a is calculated from eq. 15. Otherwise, eq. 38 is utilized)

Inclination of internal slip plane, $\psi = 61.00^\circ$ (see Fig. 28 in DEMO 82).

K_a (external stability) = 0.3073 (if batter is less than 10°, K_a is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): $N_c = 35.49$ $N_\gamma = 30.21$

SEISMICITY

Maximum ground acceleration coefficient, $A = 0.200$

Design acceleration coefficient in Internal Stability: $K_h = A_m = 0.250$

Design acceleration coefficient in External Stability: $K_h_d = 0.099 \Rightarrow K_h = A_m = 0.134$

(K_h in External Stability is based on allowable displacement, $d = 25$ mm. using AASHTO 2002 equation)

$K_{ae} (K_h > 0) = 0.3540$ $K_{ae} (K_h = 0) = 0.2705$ $\Delta K_{ae} = 0.0835$

Seismic soil-geogrid friction coefficient, F^* is 80.0% of its specified static value.

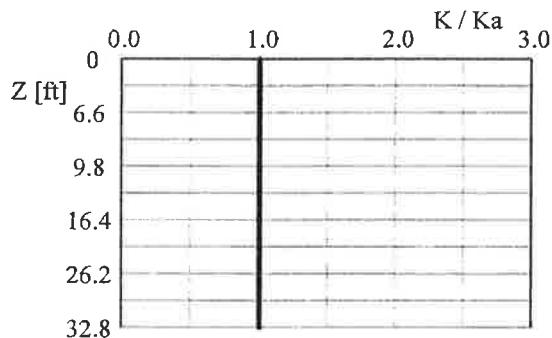
**INPUT DATA: Geogrids
(Analysis)**

D A T A	Geogrid type #1	Geogrid type #2	Geogrid type #3	Geogrid type #4	Geogrid type #5
Tult [lb/ft]	4700.0	7400.0			
Durability reduction factor, RFd	1.10	1.10			
Installation-damage reduction factor, RFid	1.10	1.10			
Creep reduction factor, RFC	1.58	1.58	N/A	N/A	N/A
Fs-overall for strength	N/A	N/A			
Coverage ratio, Rc	1.000	1.000			
Friction angle along geogrid-soil interface, ρ	21.33	21.33			
Pullout resistance factor, F*	$0.80 \cdot \tan\phi$	$0.80 \cdot \tan\phi$	N/A	N/A	N/A
Scale-effect correction factor, α	0.8	0.8			

Note: Z for calculating K/Ka and F* is measured from roadway surface (FHWA-NHI-10-024).

Variation of Lateral Earth Pressure Coefficient With Depth

Z	K / Ka
0 ft	1.00
3.3 ft	1.00
6.6 ft	1.00
9.8 ft	1.00
13.1 ft	1.00
16.4 ft	1.00
19.7 ft	1.00



MSEW -- Mechanically Stabilized Earth Walls

Layton Crossing

Present Date/Time: Fri Aug 29 10:15:09 2014

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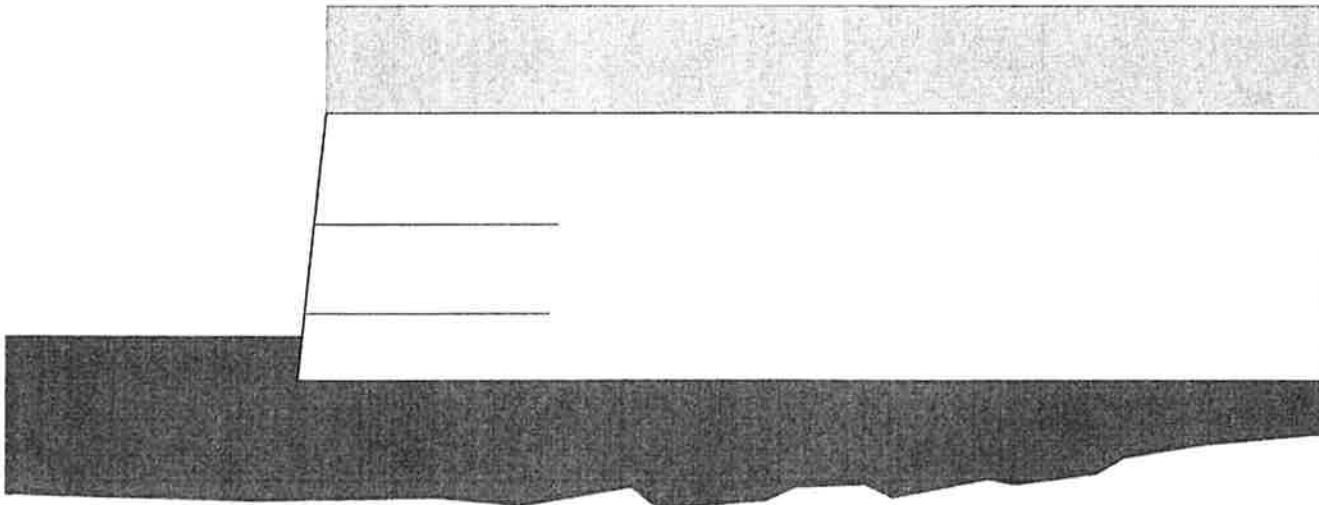
INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, Hd	8.00 [ft]	{ Embedded depth is E = 1.33 ft, and height above top of finished bottom grade is H = 6.67 ft }
Batter, ω	5.7 [deg]	
Backslope, β	0.0 [deg]	
Backslope rise	0.0 [ft]	Broken back equivalent angle, I = 0.00° (see Fig. 25 in DEMO 82)

UNIFORM SURCHARGE

Uniformly distributed dead load is 0.0 [lb/ft²], and live load is 250.0 [lb/ft²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 [ft]



ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, $F_s = 8.51$, Meyerhof stress = 1345 lb/ft².Foundation Interface: Direct sliding, $F_s = 2.237$, Eccentricity, $e/L = 0.0962$, F_s -overturning = 4.25

G E O G R I D			C O N N E C T I O N				Geogrid strength F_s	Pullout resistance F_s	Direct sliding F_s	Eccentricity e/L	Product name
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [geogrid strength]					
1	2.00	7.00	I	N/A	2.28	2.30	2.303	3.423	1.703	0.0575	Miragrid 5XT
2	4.67	7.00	I	N/A	3.14	3.17	3.167	2.092	2.370	0.0215	Miragrid 5XT

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

Bearing capacity, $F_s = 6.78$, Meyerhof stress = 1507 lb/ft².Foundation Interface: Direct sliding, $F_s = 1.654$, Eccentricity, $e/L = 0.1538$, F_s -overturning = 2.91

G E O G R I D			C O N N E C T I O N				Geogrid strength F_s	Pullout resistance F_s	Direct sliding F_s	Eccentricity e/L	Product name
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [geogrid strength]					
1	2.00	7.00	I	N/A	1.98	2.00	2.004	2.215	1.293	0.0895	Miragrid 5XT
2	4.67	7.00	I	N/A	2.69	2.72	2.719	1.328	1.911	0.0311	Miragrid 5XT

AASHTO 2002 ASD DESIGN METHOD

Layton Crossing

MSEW(3.0): Update # 14.1

PROJECT IDENTIFICATION

Title: Layton Crossing
Project Number: ES-3304.01
Client: Keywest Retaining Systems, Inc.
Designer: HTW
Station Number: 130

Description:

6.67 Foot Lock and Load wall with Traffic Surcharge

Company's information:

Name: Earth Solutions NW, LLC
Street: 1805 136th Pl NE, Ste 201

Bellevue, WA 98005
Telephone #: (425) 284-3300
Fax #:
E-Mail:

Original file path and name: C:\Users\henry.wright\Documents\Earth Solutions\3304.01.....
.....01 LnL\6.67 Foot.BEN

Original date and time of creating this file: August 29, 2014

PROGRAM MODE:

ANALYSIS
of a SIMPLE STRUCTURE
using GEOGRID as reinforcing material.



Present Date/Time: Fri Aug 29 10:15:51 2014

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SOIL DATA**REINFORCED SOIL**

Unit weight, γ	125.0 lb/ft ³
Design value of internal angle of friction, ϕ	32.0 °

RETAINED SOIL

Unit weight, γ	125.0 lb/ft ³
Design value of internal angle of friction, ϕ	32.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight, γ_{equiv}	125.0 lb/ft ³
Equivalent internal angle of friction, ϕ_{equiv}	32.0 °
Equivalent cohesion, c_{equiv}	0.0 lb/ft ²

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.3073 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)

Inclination of internal slip plane, $\psi = 61.00^\circ$ (see Fig. 28 in DEMO 82).

Ka (external stability) = 0.3073 (if batter is less than 10°, Ka is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITYBearing capacity coefficients (calculated by MSEW): $N_c = 35.49$ $N_q = 30.21$ **SEISMICITY**

Maximum ground acceleration coefficient, A = 0.200

Design acceleration coefficient in Internal Stability: $K_h = A_m = 0.250$ Design acceleration coefficient in External Stability: $K_h_d = 0.099 \Rightarrow K_h = A_m = 0.134$

(Kh in External Stability is based on allowable displacement, d = 25 mm. using AASHTO 2002 equation)

Kae ($K_h > 0$) = 0.3540 Kae ($K_h = 0$) = 0.2705 $\Delta Kae = 0.0835$

Seismic soil-geogrid friction coefficient, F* is 80.0% of its specified static value.

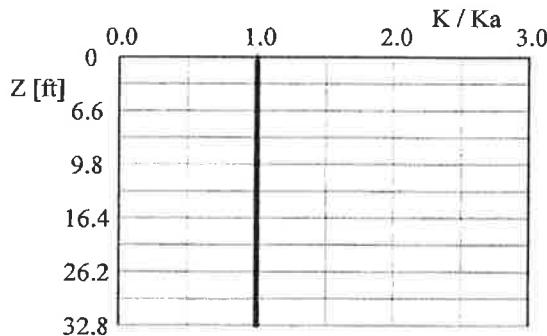
**INPUT DATA: Geogrids
(Analysis)**

D A T A	Geogrid type #1	Geogrid type #2	Geogrid type #3	Geogrid type #4	Geogrid type #5
Tult [lb/ft]	4700.0	7400.0			
Durability reduction factor, RFd	1.10	1.10			
Installation-damage reduction factor, RFid	1.10	1.10			
Creep reduction factor, RFC	1.58	1.58	N/A	N/A	N/A
Fs-overall for strength	N/A	N/A			
Coverage ratio, Rc	1.000	1.000			
Friction angle along geogrid-soil interface, ϕ	21.33	21.33			
Pullout resistance factor, F*	0.80 · tan ϕ	0.80 · tan ϕ	N/A	N/A	N/A
Scale-effect correction factor, α	0.8	0.8			

Note: Z for calculating K/Ka and F* is measured from roadway surface (FHWA-NHI-10-024).

Variation of Lateral Earth Pressure Coefficient With Depth

Z	K / Ka
0 ft	1.00
3.3 ft	1.00
6.6 ft	1.00
9.8 ft	1.00
13.1 ft	1.00
16.4 ft	1.00
19.7 ft	1.00



MSEW -- Mechanically Stabilized Earth Walls

Layton Crossing

Present Date/Time: Fri Aug 29 10:15:51 2014

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INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

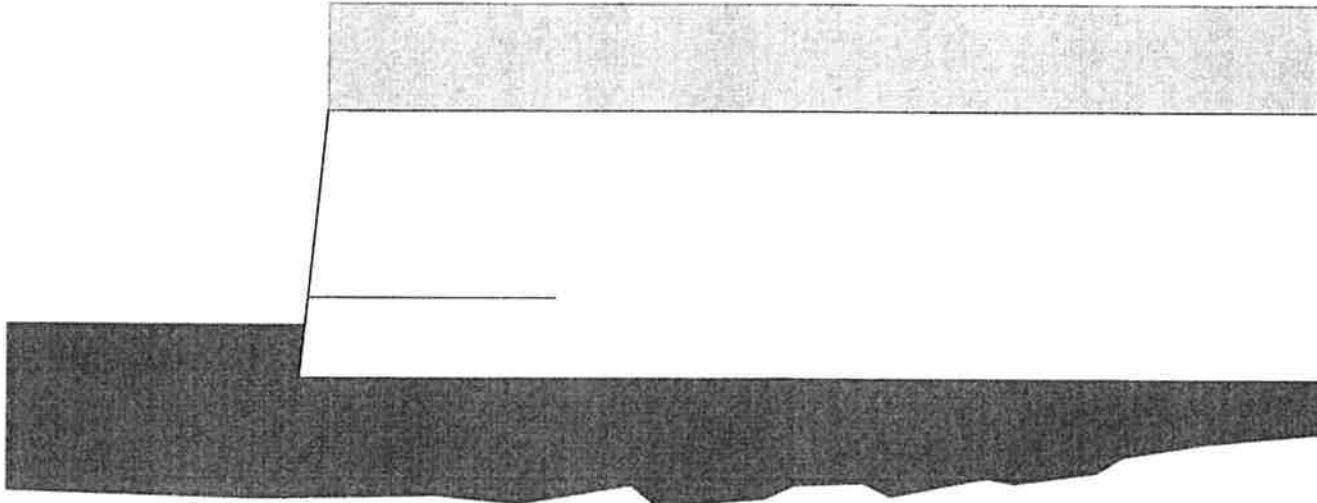
Design height, Hd 6.66 [ft] { Embedded depth is E = 1.33 ft, and height above top of finished bottom grade is H = 5.33 ft }

Batter, ω 5.7 [deg]
Backslope, β 0.0 [deg]
Backslope rise 0.0 [ft] Broken back equivalent angle, I = 0.00° (see Fig. 25 in DEMO 82)

UNIFORM SURCHARGE

Uniformly distributed dead load is 0.0 [lb/ft²], and live load is 250.0 [lb/ft²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 [ft]

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, $F_s = 8.48$, Meyerhof stress = 1161 lb/ft².Foundation Interface: Direct sliding, $F_s = 2.163$, Eccentricity, $e/L = 0.0998$, F_s -overturning = 4.15

G E O G R I D			C O N N E C T I O N			Geogrid strength F_s	Pullout resistance F_s	Direct sliding F_s	Eccentricity e/L	Product name	
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [geogrid strength]					
1	2.00	6.00	1	N/A	1.79	1.80	1.803	1.740	1.693	0.0544	Miragrid 5XT

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

Bearing capacity, $F_s = 6.91$, Meyerhof stress = 1286 lb/ft².Foundation Interface: Direct sliding, $F_s = 1.626$, Eccentricity, $e/L = 0.1541$, F_s -overturning = 2.91

G E O G R I D			C O N N E C T I O N			Geogrid strength F_s	Pullout resistance F_s	Direct sliding F_s	Eccentricity e/L	Product name	
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [geogrid strength]					
1	2.00	6.00	1	N/A	1.56	1.57	1.573	1.131	1.318	0.0805	Miragrid 5XT

AASHTO 2002 ASD DESIGN METHOD Layton Crossing

MSEW(3.0): Update # 14.1

PROJECT IDENTIFICATION

Title: Layton Crossing
Project Number: ES-3304.01
Client: Keywest Retaining Systems, Inc.
Designer: HTW
Station Number: 130

Description:

5.33 Foot Lock and Load wall with Traffic Surcharge

Company's information:

Name: Earth Solutions NW, LLC
Street: 1805 136th Pl NE, Ste 201

Bellevue, WA 98005
Telephone #: (425) 284-3300
Fax #:
E-Mail:

Original file path and name: C:\Users\henry.wright\Documents\Earth Solutions\3304.01....
.....01 LnL5.33 Foot.BEN

Original date and time of creating this file: August 29, 2014

PROGRAM MODE:

ANALYSIS
of a SIMPLE STRUCTURE
using GEOGRID as reinforcing material.



SOIL DATA**REINFORCED SOIL**

Unit weight, γ	125.0 lb/ft ³
Design value of internal angle of friction, ϕ	32.0 °

RETAINED SOIL

Unit weight, γ	125.0 lb/ft ³
Design value of internal angle of friction, ϕ	32.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight, γ_{equiv}	125.0 lb/ft ³
Equivalent internal angle of friction, ϕ_{equiv}	32.0 °
Equivalent cohesion, c_{equiv}	0.0 lb/ft ²

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.3073 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)

Inclination of internal slip plane, $\psi = 61.00^\circ$ (see Fig. 28 in DEMO 82).

Ka (external stability) = 0.3073 (if batter is less than 10°, Ka is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): $N_c = 35.49$ $N_q = 30.21$

SEISMICITY

Maximum ground acceleration coefficient, A = 0.200

Design acceleration coefficient in Internal Stability: $K_h = A_m = 0.250$

Design acceleration coefficient in External Stability: $K_h = A_m = 0.134$

(Kh in External Stability is based on allowable displacement, d = 25 mm. using AASHTO 2002 equation)

$K_{ae} (Kh > 0) = 0.3540$ $K_{ae} (Kh = 0) = 0.2705$ $\Delta K_{ae} = 0.0835$

Seismic soil-geogrid friction coefficient, F^* is 80.0% of its specified static value.

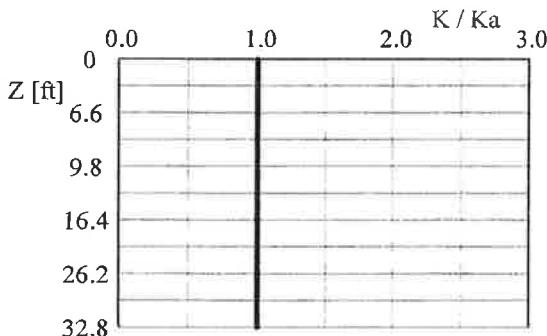
INPUT DATA: Geogrids (Analysis)

DATA		Geogrid type #1	Geogrid type #2	Geogrid type #3	Geogrid type #4	Geogrid type #5
Tult [lb/ft]		4700.0	7400.0			
Durability reduction factor, RFd		1.10	1.10			
Installation-damage reduction factor, RFid		1.10	1.10			
Creep reduction factor, RFC		1.58	1.58	N/A	N/A	N/A
Fs-overall for strength		N/A	N/A			
Coverage ratio, Rc		1.000	1.000			
Friction angle along geogrid-soil interface, ϕ	p	21.33	21.33			
Pullout resistance factor, F*		0.80 · tan ϕ	0.80 · tan ϕ	N/A	N/A	N/A
Scale-effect correction factor, α		0.8	0.8			

Note: Z for calculating K/Ka and F* is measured from roadway surface (FHWA-NHI-10-024).

Variation of Lateral Earth Pressure Coefficient With Depth

Z	K / Ka
0 ft	1.00
3.3 ft	1.00
6.6 ft	1.00
9.8 ft	1.00
13.1 ft	1.00
16.4 ft	1.00
19.7 ft	1.00



INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, H_d 5.33 [ft] { Embedded depth is $E = 1.33$ ft, and height above top of finished bottom grade is $H = 4.00$ ft }

Batter, ω	5.7	[deg]
Backslope, β	0.0	[deg]
Backslope rise	0.0	[ft]

Broken back equivalent angle, $\bar{\alpha} = 0.00^\circ$ (see Fig. 25 in DEMO 82)

UNIFORM SURCHARGE

Uniformly distributed dead load is 0.0 [lb/ft²], and live load is 250.0 [lb/ft²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

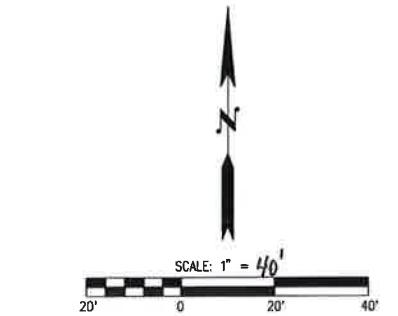
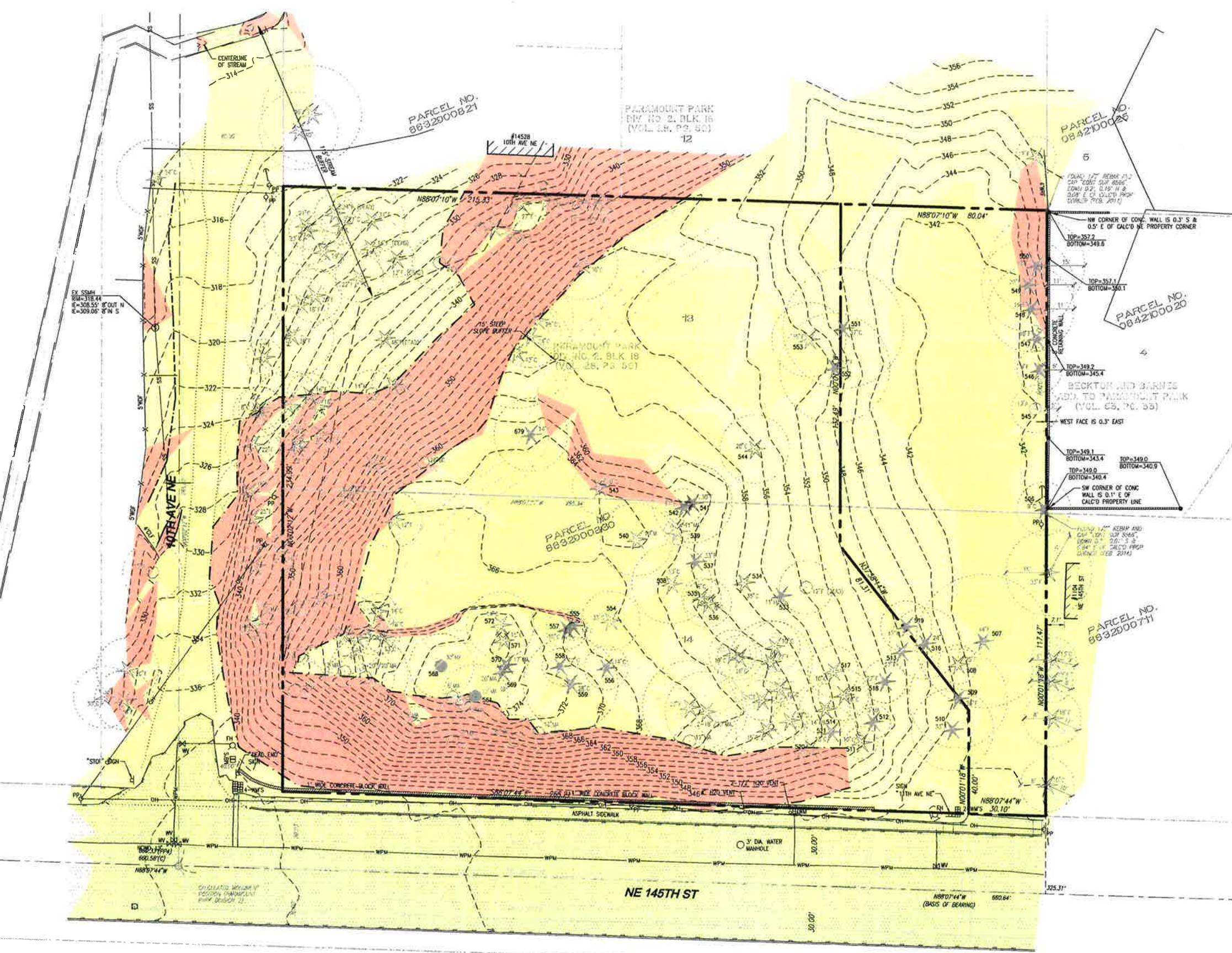
0 2 4 6 [ft]

ANALYSIS: CALCULATED FACTORS (Static conditions)Bearing capacity, $F_s = 11.17$, Meyerhof stress = 937 lb/ft².Foundation Interface: Direct sliding, $F_s = 2.500$, Eccentricity, $e/L = 0.0681$, F_s -overturning = 5.81

GEO GRID			CONNECTION			Geogrid strength F_s	Pullout resistance F_s	Direct sliding F_s	Eccentricity e/L	Product name	
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [geogrid strength]					
1	2.00	6.00	1	N/A	2.55	2.57	2.574	1.775	2.023	0.0317	Miragrid 5XT

ANALYSIS: CALCULATED FACTORS (Seismic conditions)Bearing capacity, $F_s = 9.98$, Meyerhof stress = 991 lb/ft².Foundation Interface: Direct sliding, $F_s = 1.920$, Eccentricity, $e/L = 0.1024$, F_s -overturning = 4.20

GEO GRID			CONNECTION			Geogrid strength F_s	Pullout resistance F_s	Direct sliding F_s	Eccentricity e/L	Product name	
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [geogrid strength]					
1	2.00	6.00	1	N/A	2.25	2.27	2.271	1.172	1.631	0.0449	Miragrid 5XT



WYNDHAM HOMES, LLC
LAYTON CROSSING
SLOPE ANALYSIS MAP

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